## 5. Drawings

Fig 1:

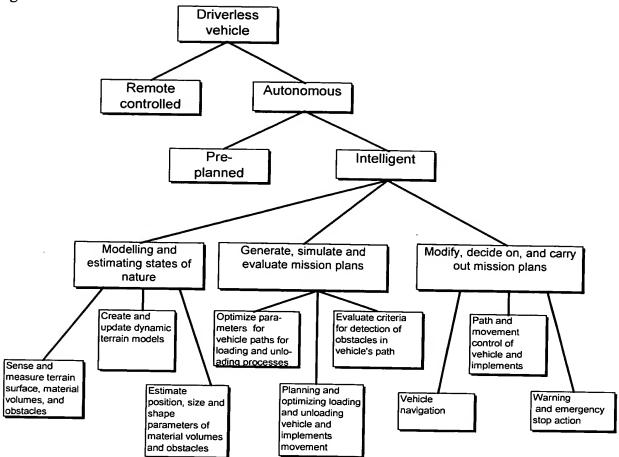


Fig 2:

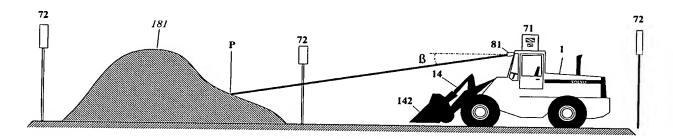


Fig 3:

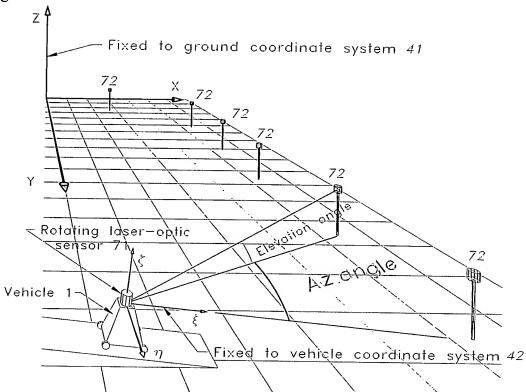


Fig 4:

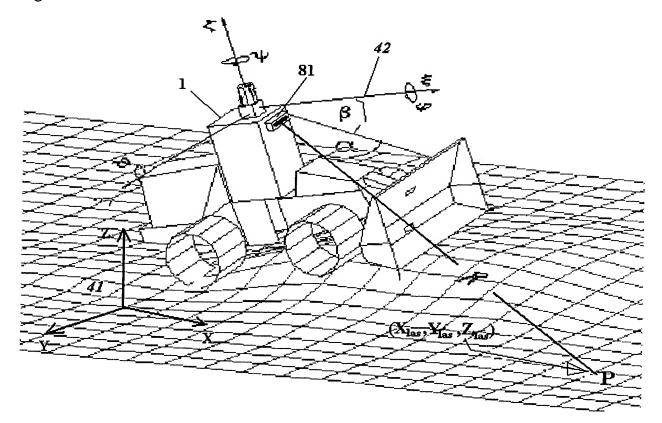


Fig 5:

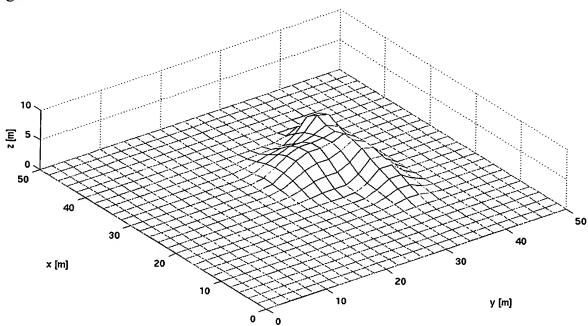


Fig 6:

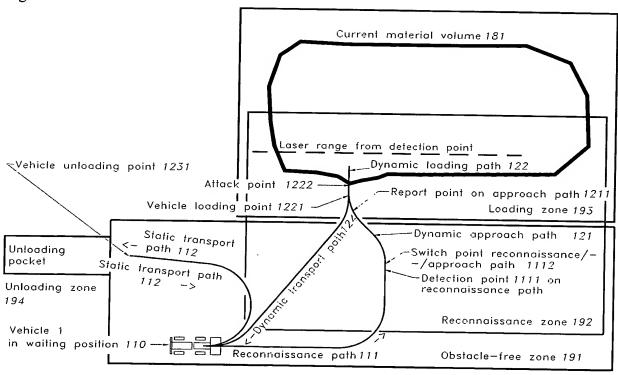


Fig 7:

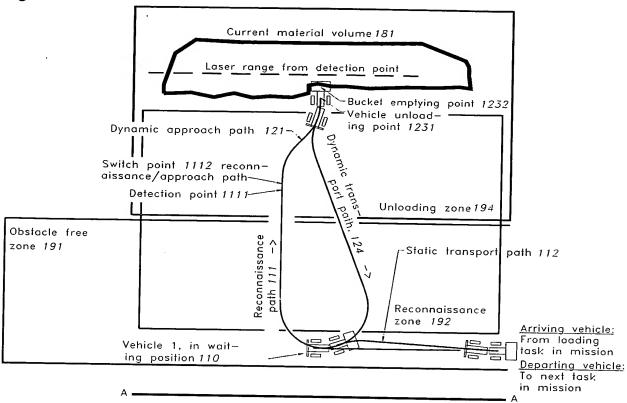


Fig 8:

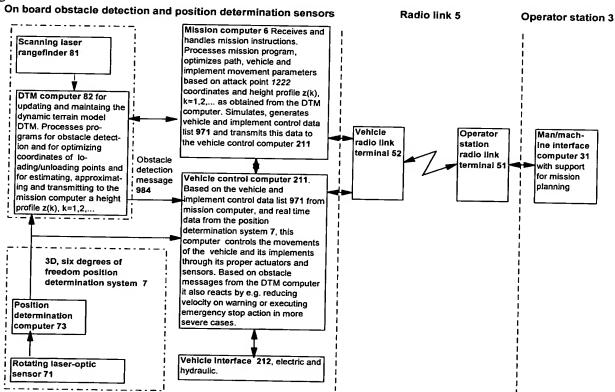


Fig 9:

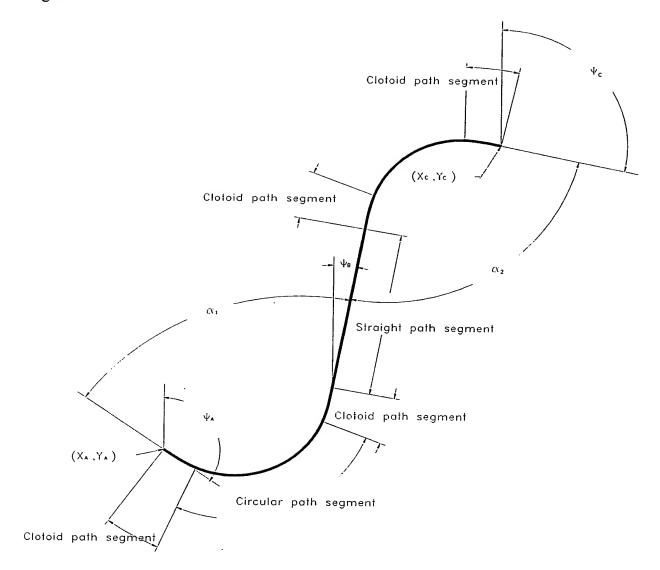


Fig 10:

Flow and exchange of mission instructions and lower level messages, in a reconnaissance and loading task

## DTM comput r Mission comput r V hicle control V computer hicle Receive reconnaissance On "ready" message from the Start ==> and obstacle detection vehicle control computer: On radio command: In waiassignment instructions Send reconnaissance and Start engine. Read current ting from the mission computer. obstacle detection assignment position. Send "ready" posi-Evaluate criteria for instructions to the DTM message to the mission tion location within obstacle computer. Simulate computer. free or loading zone. reconnaissance path. Generate vehicle control data list and send On vehicle control data list Inside reconnaissance this list to the vehicle control and from mission computer: Drive <u>zone</u> DTM computers.Go to standby in Start and drive the veh-icle recon-Evaluate criteria for detecattending detection message according to the data list naistion of forward edge of from the DTM computer. and attend path switch sance volume of material message from the mission path On detection message from the computer. On detection of forward DTM computer edge of volume of material Optimize parameters for dynamic On path switch message Send detection message to approach path and determine the and approach path vehicle the mission computer with coordinates of the switch point for and implement control data position of the loading changing from reconnaissance to position and the current approach path. Send report point Continue driving vehicle position, orientation and message to the DTM computer. along the reconnaissance speed of the vehicle. Simulate dynamic approach path. path to the switch point Generate vehicle control data list reconnaissance/approach On report point message and send path switch message path from the mission computer and approach path vehicle and Evaluate criteria for arrival implement control data list to the On and past arrival at Drive to report point. vehicle control and DTM switch point reconndynamic Continuously update the computers.Go to standby in aissance/approach path: apprterrain model inside attending arrival message and Drive vehicle along oach loading zone by using loading profile data list from the dynamic approach path path available measurements DTM computer. from the scanning laser On approach path/loading rangefinder. On loading path message from path switch message and the DTM computer: loading path vehicle and Optimize parameters for loading implement control data list. On arrival to report point path and coordinates for switch Continue driving vehicle on approach path prior to point approach path/loading path along the recon-naissance and send path switch message loading path path to the switch point Drive Send loading path and vehicle and implement reconnaiss-ance/approach loading message with estimated control data list to the vehicle path path approximate loading profile control and DTM computers. and z(k), k=1,2,... in the fixed to On and past arrival at control ground coordinate system On "ready" message from vehicle switch point buckto the mission computer. control computer Drive vehicle along loading et a) Normal "ready"-message. path and control vehicle Continue mission with retrun from speed and bucket loading etc. movements according to b) Emergency stop message the received control data Inside obstacle-free zone Break remaining autonomous list. Evaluate criteria for functions of mission program and existence of obstacles return initiative to operator On finished loading task: inside obstacle-free zone. station. Send "ready"-message to On warning or emergency mission computer conditions, send corresponding signals to vehicle control computer.

Fig 11:

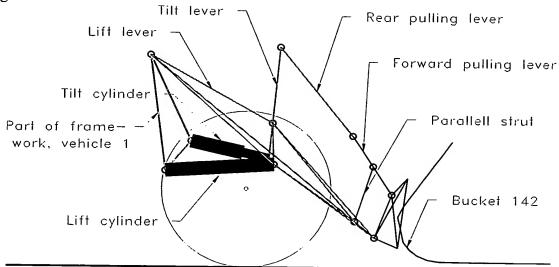


Fig 12:

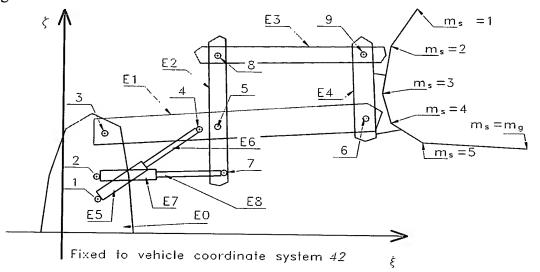


Fig 13:

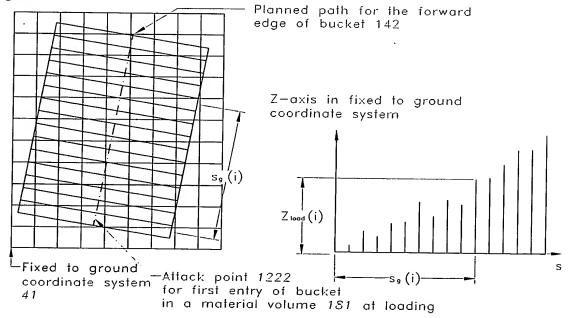


Fig 14:

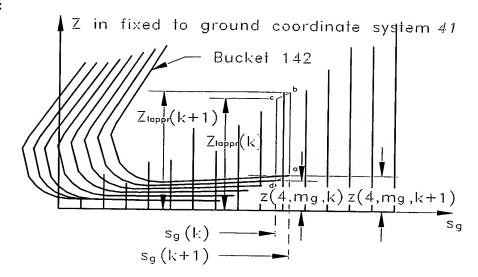


Fig 15:

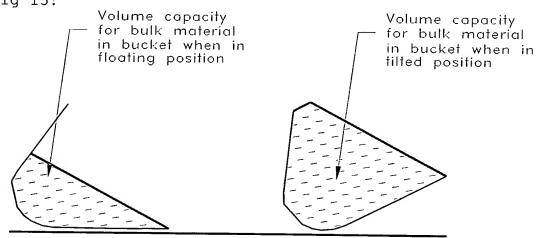


Fig 16:

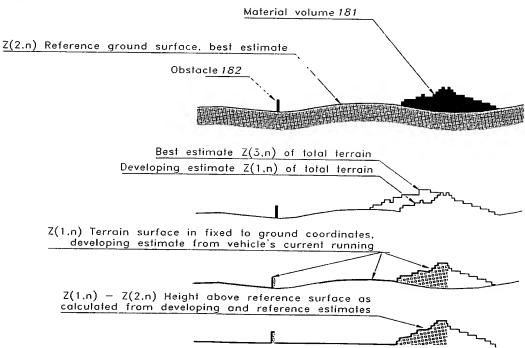


Fig 17:

